



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,838	10/08/2004	Pei-Yu Chou	13869-US-PA	5837

31561 7590 11/25/2005

JIANQ CHYUN INTELLECTUAL PROPERTY OFFICE
7 FLOOR-1, NO. 100
ROOSEVELT ROAD, SECTION 2
TAIPEI, 100
TAIWAN

EXAMINER

CHEN, ERIC BRICE

ART UNIT	PAPER NUMBER
----------	--------------

1765

DATE MAILED: 11/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/711,838

Applicant(s)

CHOU, PEI-YU

Examiner

Eric B. Chen

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 October 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-2 and 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (U.S. Patent No. 6,692,903).

3. As to claim 1, Chen discloses an etching process, comprising: providing a material layer having a bottom anti-reflection coating (BARC) (50) (column 4, lines 1-2) and a patterned photoresist layer (60) thereon (Figure 1A); etching the BARC (50) using the patterned photoresist (60) layer as a mask (column 6, lines 19-22), wherein polymer as an etching by-product is formed on the patterned photoresist layer (column 7, lines 55-67); performing a cleaning step to remove the polymer from the patterned photoresist layer (column 6, lines 19-22); and etching the material layer (45) using the patterned photoresist layer as a mask (column 6, lines 19-22).

4. Chen does not expressly disclose that the cleaning step is performed before the step of etching the material layer. However, case law has held that the transposition of process steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). Thus, the claim

limitation of performing the cleaning step before the step of etching the material layer is the transposition of process steps, where the processes are substantially identical or equivalent in terms of function, manner and result. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the cleaning step before the step of etching the material layer.

5. As to claim 2, Chen discloses that the cleaning step comprises using an ionized gas to remove the polymer from the patterned photoresist layer (column 7, lines 55-60).

6. As to claim 4, Chen discloses that the material layer (45) comprises a polysilicon layer (column 3, lines 34-43).

7. As to claim 5, Chen discloses that the ionized gas contains fluorine ions, oxygen ions, or a combination thereof (column 7, lines 63-67).

8. As to claim 6, Chen discloses that the BARC (50) comprises an inorganic material (column 4, lines 1-2).

Claim Rejections - 35 USC § 103

9. Claims 8-10 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Mui et al. (U.S. Patent Appl. Pub. No. 2003/0228532).

10. As to claim 8, Chen does not expressly disclose trimming the patterned photoresist layer after the material layer is provided. However, Mui teaches that the optical limitations to the lithographic process may not allow the transfer of a feature to photoresist, if the feature is smaller than the optical resolution of the lithographic

process (paragraph 0008). To overcome optical limitations, dimensions of features can be further reduced by photoresist trimming (paragraph 0009). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to trim the patterned photoresist layer. One who is skilled in the art would be motivated to overcome the limitations of optical resolution to achieve smaller dimensions by photoresist trimming.

11. As to claim 9, Chen discloses a patterning process, comprising: sequentially forming a bottom anti-reflection coating (BARC) (50) (column 4, lines 1-2) and a photoresist layer (60) (column 4, lines 4-7) on a material layer (Figure 1A); performing a lithography process to pattern the photoresist layer (60) (column 4, lines 4-7), etching the BARC (50) using the patterned photoresist layer (60) as a mask, wherein polymer as an etching by-product is formed on the patterned photoresist layer (column 4, lines 31-37), performing a cleaning step to remove the polymer from the patterned photoresist layer (column 7, lines 55-67), and etching the material layer (45) using the patterned photoresist layer as a mask (column 6, lines 19-22), wherein the step of etching the BARC, the cleaning step and the step of etching the material layer are performed in-situ (column 4, lines 50-62; column 6, lines 52-65).

12. Chen does not expressly disclose trimming the patterned photoresist layer. However, Mui teaches that the optical limitations to the lithographic process may not allow the transfer of a feature to photoresist, if the feature is smaller than the optical resolution of the lithographic process (paragraph 0008). To overcome optical limitations, dimensions of features can be further reduced by photoresist trimming (paragraph

0009). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to trim the patterned photoresist layer. One who is skilled in the art would be motivated to overcome the limitations of optical resolution to achieve smaller dimensions by photoresist trimming.

13. Chen does not expressly disclose that the cleaning step is performed before the step of etching the material layer. However, case law has held that the transposition of process steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). Thus, the claim limitation of performing the cleaning step before the step of etching the material layer is the transposition of process steps, where the processes are substantially identical or equivalent in terms of function, manner and result. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the cleaning step before the step of etching the material layer.

14. As to claim 10, Chen discloses that the cleaning step comprises using an ionized gas to remove the polymer from the patterned photoresist layer (column 7, lines 55-60).

15. As to claim 12, Chen discloses that the material layer (45) comprises a polysilicon layer (column 3, lines 34-43).

16. As to claim 13, Chen discloses that the ionized gas contains fluorine ions, oxygen ions, or a combination thereof (column 7, lines 63-67).

17. As to claim 14, Chen discloses that the BARC (50) comprises an inorganic material (column 4, lines 1-2).

Claim Rejections - 35 USC § 103

18. Claims 3 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Wolf et al., *Silicon Processing for the VLSI Era*, Vol. 1, Lattice Press (1986) ("Wolf I").

19. As to claims 3 and 11, Chen does not expressly disclose that the ionized gas has a higher etching rate to the polymer than to the material layer. Wolf I teaches that both the mask material and underlying material are subjected to etchant attack during etching (page 523). Moreover, Wolf I teaches that selectivity of the etch process is an important characteristic to the etch process (page 523). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select an ionized gas with a higher etching rate to the polymer than to the material layer. One who is skilled in the art would select a selectivity targeted for the removal of the desired film.

Claim Rejections - 35 USC § 103

20. Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002) ("Wolf IV").

21. As to claims 7 and 15, Chen does not expressly disclose that the BARC comprises an organic material. However, Wolf IV teaches that the application of organic BARCS have the advantages of low cost, refractive index reproducibility, planarization

Art Unit: 1765

capability, film thickness tolerance, rework capability, and surface control (page 248).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an organic BARC. One who is skilled in the art would be motivated to use an organic BARC, due to its many advantages.

Response to Arguments

22. Applicant's arguments (Applicants' Remarks, page 5), filed Oct. 13, 2005, with respect to the rejection of claims 1-2 and 4-6 under 35 U.S.C. 102(b) as being anticipated by Chen have been fully considered and are persuasive. Applicant has pointed out that the Chen reference does not disclose the claim limitation that "the cleaning step is performed before the step of etching the material layer" (page 5). Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Chen.

23. Applicant's arguments (Applicants' Remarks, pages 7-8), filed Oct. 13, 2005, with respect to the rejection of claims 8-10 and 12-14 under 35 U.S.C. 103(a) as being unpatentable over Chen, in view of Mui, have been fully considered and are persuasive, as discussed above. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Chen.

24. Applicant's arguments (Applicants' Remarks, pages 7-8), filed Oct. 13, 2005, with respect to the rejection of claims 3 and 11 under 35 U.S.C. 103(a) as being unpatentable over Chen, in view of Wolf I, have been fully considered and are persuasive, as discussed above. Therefore, the rejection has been withdrawn.

Art Unit: 1765

However, upon further consideration, a new ground(s) of rejection is made in view of Chen.

25. Applicant's arguments (Applicants' Remarks, pages 7-8), filed Oct. 13, 2005, with respect to the rejection of claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over Chen, in view of Wolf IV, have been fully considered and are persuasive, as discussed above. Therefore, the rejection has been withdrawn.

However, upon further consideration, a new ground(s) of rejection is made in view of Chen.

Conclusion

26. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Chen whose telephone number is (571) 272-2947. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

EBC
Nov. 14, 2005

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

